# INSTRUCTION MANUAL

# FOR

# TRANSISTOR POWER PACK MODEL 212-A

ELECTRONIC MEASUREMENTS COMPANY, INC.

EATONTOWN NEW JERSEY

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# TRANSISTOR POWER PACK MODEL 212-A*

*(PATENT PENDING)

ELECTRONIC MEASUREMENTS COMPANY, INC.
LEWIS STREET AND MAPLE AVENUE
EATONTOWN, NEW JERSEY
TELEPHONE - EATONTOWN 3-0300

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# INSTRUCTION MANUAL FOR TRANSISTOR POWER PACK MODEL 212-A

## I. GENERAL

### 1. Description:

The Model 212-A is a compact source of D.C. power especially designed to provide steady low voltages such as are required in transistor work. The use of a 10 volt electrical vernier makes practical the resolution of small voltages to a fraction of a volt. Extremely low ripple and good regulation provide performance superior to that of the average battery. For this reason (coupled with its very light weight), this unit finds ready application as a general purpose "battery" for the laboratory or shop, comprising such uses as bridge power, test voltage, strain gauge excitation, etc. The output may be modulated electrically with small signals or controlled remotely over its entire range via a coaxial line.

### 2. Inspection:

When the unit is received it should be unpackaged and inspected for any sign of damage or mishandling. Inspect to see that the tubes are secure in their sockets. The unit may be opened for inspection by removing the cover screws and cover. See the Warranty Page at the rear of this manual for instructions in the event that damage is revealed.

## II. OPERATION

### 1. Installation:

#### 1.1 Power:

This unit requires a source of 105 to 125 volts at 50 to 60 cycles, single phase, A.C.

#### 1.2 Placement:

For table use it is merely necessary to place the unit on a flat surface, on the 4 rubber feet provided. A number of units may be stacked, if desired. For rack use the unit may be installed in the conventional manner, except that, in some cases, the rubber feet may have to be removed from the bottom cover. In any case, there should be an opportunity for air to circulate through the ventilation openings provided.

2. Preliminary:

To operate this unit, proceed as follows:

a. Place the switches and controls in the following positions:

(1) Line Switch - off (down).

(2) High Voltage Switch - off (down).

(3) High Voltage and Vernier Controls - minimum (maximum counter-clockwise).

(4) Ground Switch - set to the desired grounding condition. + or - (center position provides no case ground).

b. Make load connections to the binding posts at the right front of the unit. Keep in mind that with negative ground the lower black post is at ground potential, and with positive ground the red post is at ground potential.

NOTE.

The regulation of this unit is measured at the binding posts; in use, the load leads should be made heavy enough to reduce the drop to acceptable limits.

c. Plug the line cord into an appropriate outlet. Operate the line switch to the on position (green indicator will glow).

d. After about a minute apply voltage to the load by operating the high voltage switch to the on position (up, red indicator will glow).

WARNING!!

When first turning on this unit, the D.C. switch should always be in the off position. It is arranged to throw a short across the output binding posts, thus effectively preventing the application of any excess voltages to the load during warm-up. Subsequently, the D.C. switch may be operated on or off with no danger of exceeding the set voltage.

3. Adjustment of Voltages:

3.1 High Voltage Control:

This control covers the range from 0 to 100 volts. Set the control to the desired voltage employing the panel calibration or the meter, where supplied.

3.2 Vernier:

This control covers 0 to 10 volts. When set to any value this reading should be added to that of the HV control reading to obtain total output voltage. When using voltages of 10 volts or less it is advisable to set the high voltage control to 0 and use only the vernier to realize its greater steadiness.

4. Modulation:

The output voltage may be offset by a D.C. signal, or alternatively modulated by an A.C. signal by inserting the appropriate voltage into the MOD circuit.

4.1 Negative Ground:

The modulation input is returned to the negative of the high voltage; thus, when the negative is grounded one side of the modulation circuit is at ground potential.

4.2 Positive Ground:

When positive ground is employed the modulation input is below ground by whatever potential the high voltage is set to. Thus, both sides of the modulation source must be above ground. If only a grounded source is available, modulation may be applied between ground and the MOD post provided that a capacitor and a 1,200 ohm resistor (in series) are placed in series with this connection. The capacitor should be sufficiently large to pass the lowest desired modulating frequency. Variations of the above for D.C., etc., will suggest themselves to the user.

4.3 Capability:

When used with no load on the high voltage, the specified modulation is only possible up to about 400 cycles; however, by maintaining a load of about 30 mils the specified modulation can be obtained up to about 10 KC. The useful load can, of course, provide all or part of this. At voltages under 10 volts the modulation capability is again somewhat reduced because of the excessive A.C.

currents flowing. For example, a 10 ohm load (full load at 1 volt) requires 200 mils RMS with 2 volts of A.C. modulation.

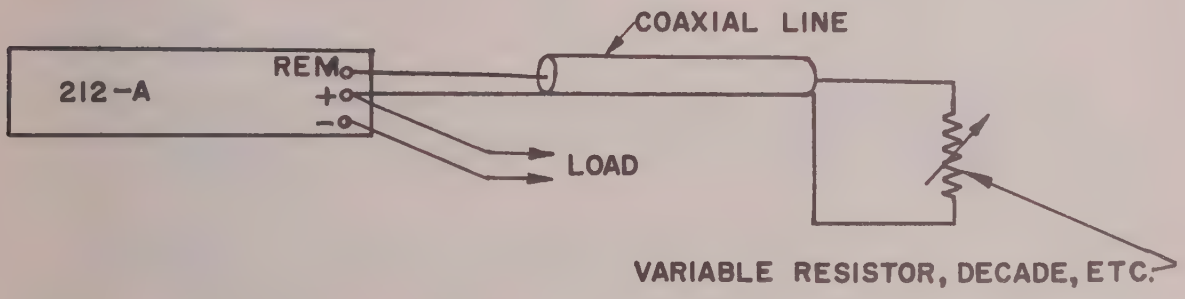
5. Remote Control:

Three posts are provided at the right hand side of this unit. The two lower ones are normally for high voltage output. The upper one is required for remote control but when not so employed may be used as an additional + post. When it is desired to set up for remote control, proceed as follows:

a. Remove the top cover.

b. Cut away the short jumper between the + H.V. post and the remote post.

c. Replace the cover and set up remote connections as follows:




d. Set both panel controls to zero and make load connections in the conventional manner.

The output voltage is then controlled by resistor R which may be a decade rheostat, etc. The output voltage is controlled according to the simple relation $E_0 = KR$. In this case, K is $\frac{1}{1,000}$. Thus, 1,000 ohms of inserted resistance will be required for each volt of output.

NOTE.

The outer sheath of the coax carries output potential; therefore, it is advisable to use an insulated cable at all times, such as RG 58/U line.

If it is desired to avoid the possibility of disturbing the output voltage by motion of the panel controls, these may be simply shorted out electrically when the cover is off.

To restore this unit for conventional operation it is merely necessary to remove the remote control cable, and restore connections altered above.

## III. MAINTENANCE

1. Replacements:

When replacements are required any parts may be used of the values and tolerances indicated on the circuit diagram, with the exception of the items listed below.

1.1 V3, V8 Tubes:

Changing either of these tubes may affect the zero balance so it should be checked in accordance with the instructions below.

1.2 V4 Tube:

Changing this tube affects the reference voltage; therefore, it will be necessary to perform the calibration adjustment in accordance with instructions below.

1.3 High Voltage and Vernier Controls:

If either of these potentiometers becomes faulty, a replacement should be obtained providing the proper effective arc to fit the panel calibration. The calibration arc is 280°. If desired, replacements may be obtained from the factory.

1.4 V9, V10 Tubes:

Because of large mu variations in production, some 6L6 tubes may be found which will lose control, particularly at the higher line voltages. Such tubes cannot be used.

2. Series Tubes:

If, at any time, it is believed that a series tube and/or associated circuits is faulty, this may be checked as follows:

a. Remove 1 series tube.

b. Turn the unit on and apply a load of 50 M.A. at 100 volts. Check ripple and regulation.

c. Remove the first series tube and repeat with the other tube in the second socket.

d. If a test gives a faulty result, repeat it using a tube known to be good.

e. If a favorable result is obtained, it may be taken that the previous tube is faulty. If not, the associated circuits should be checked for faults.

3. Zero Adjustment:

The zero adjustment is used to set the input comparator system to a zero level, which then holds over the entire operating range. This control may be found on the chassis. To set this adjustment, remove the cover and proceed as follows:

a. Turn the unit on and rotate the high voltage and vernier controls to zero.

b. Connect a voltmeter to the high voltage output terminals (full scale sensitivity 3 volts D.C. or less).

c. Set this control to obtain a reading of zero. A very sensitive indication may be obtained by alternately connecting and disconnecting the voltmeter lead.

4. Calibration Adjustment:

Calibration may be performed in one of two ways:

a. To make the panel calibrations read correctly.

b. To provide remote control calibration of 1,000 ohms per volt.

To perform the calibration adjustment a reasonably precise meter or source of voltage must be available. The preferred calibrating voltage is 100 volts, if available.

a. Connect the power unit to the measuring device.

b. Set the vernier control to zero and the high voltage control to read 100 volts. For external resistance

control, set both controls to zero and the external resistance to precisely 100,000 ohms.

c. Set the calibrating control to read 100 volts.

## V. APPLICATION NOTES

1. Resolution:

Because only 100 volts is covered in the rotation of the high voltage control, good resolution is realized. However, where higher resolution is desired, the high voltage control may be used for a coarse setting and the vernier for fine setting. For voltages of 10 volts or less the vernier alone may be used (with HV control at zero) to realize improved stability.

2. Small Signal Measurements:

One method for the measurement of transistor parameters requires the superposition of a small A.C. signal on one of the D.C. potentials. This unit is particularly suitable for this since the D.C. voltage may be set independently, and modulation then introduced to provide the required small signal (subject to the instructions given above).

3. Bridge Measurements:

As described for transistor applications, this unit may be used to provide separately adjustable A.C. and D.C. excitation for bridges, strain gauges, etc.

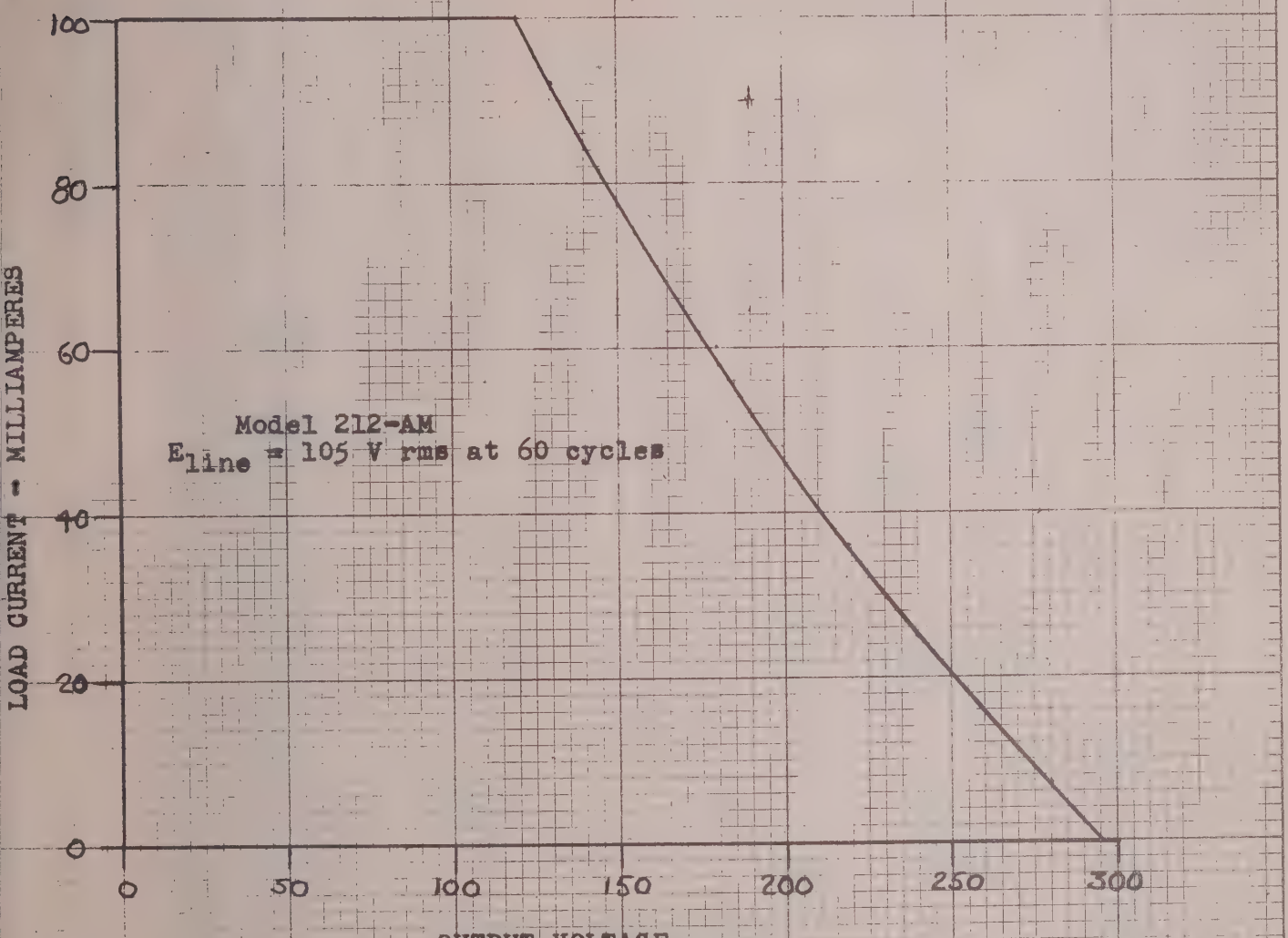
4. Oscillation:

This unit permits modulation of the output voltage by a suitable signal. To make this possible the output system has been made relatively "soft". Because of this, some sensitivity to the type of load is present. Thus a capacitor of .1 microfarad directly across the output may cause high frequency oscillation. To eliminate this sensitivity, a capacitor of about 20 ufds may be connected directly across the output. This, of course, disables the modulation feature except at very low frequencies.

5. Production Testing:

Where either fixed or variable multiple potentials are required for production test installations these power packs may readily be employed because of small size, light weight, and the possibility of stacking. In addition, they lend themselves readily to automation conversions, or installations since they are programmable through the remote control line.

K+E 358-5P
10 × 10 to the inch.



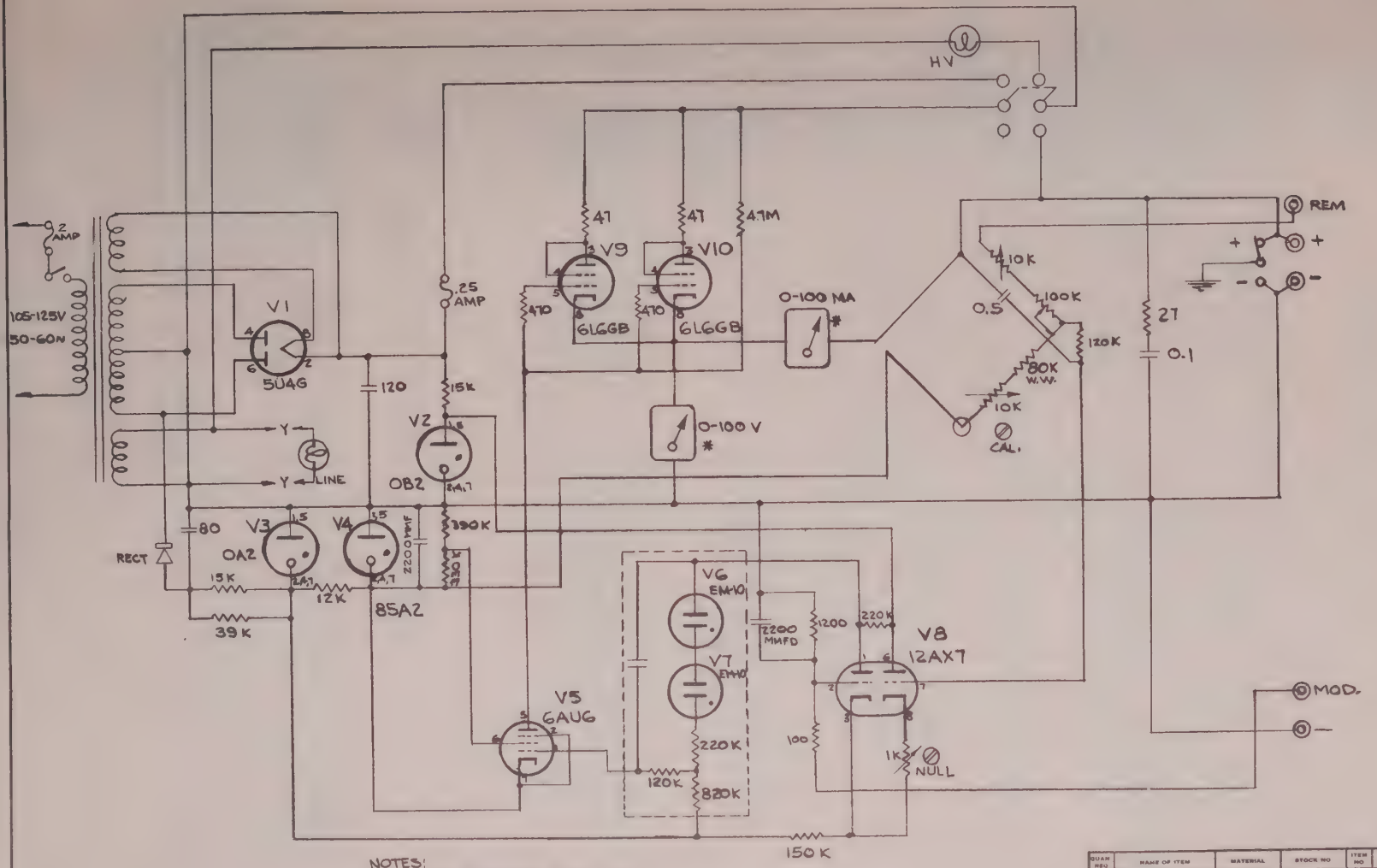

MAXIMUM OUTPUT CURRENT VERSUS OUTPUT VOLTAGE FOR 212-A (OR 212-AM) TRANSISTOR POWER PACK.
FOR GIVEN OUTPUT VOLTAGE ($E_o$), CONTROL RESISTOR REQUIRED = $1000E_o$

ELECTRONIC MEASUREMENTS COMPANY, INC.
LEWIS STREET AND MAPLE AVENUE
EATONTOWN, NEW JERSEY

9/55

KEUFFEL & ESSER CO.
MADE IN U.S.A.

| ISSUE | DESCRIPTION OF CHANGE |
|---|---|
| 3-30-56 | REDRAWN-APPLIES ABOVE SER. 176 |




NOTES:

1- UNLESS OTHERWISE SPECIFIED:
CAPACITANCE IS GIVEN IN MF., AND RESISTANCE IN OHMS K=1000 M=1,000,000

2 # MODEL 212AM ONLY

3 ⊘ SCREWDRIVER ADJUSTMENT ON CHASSIS

| QUAN REQ | NAME OF ITEM | MATERIAL | STOCK NO | ITEM NO | REMARKS |
|---|---|---|---|---|---|

# SCHEMATIC
## MODEL 212A-AM

| | | | |
|---|---|---|---|
| DRAWN BY MACH | DATE 3-30-56 | USED ON | ISSUE LETTER |
| TRACED BY | ENGINEER C.A.B | | |
| CHECKED | SCALE | | |

ELECTRONIC MEASUREMENTS COMPANY
RED BANK NEW JERSEY

DRAWING NO 332-C-9 B

WHEN REFERRING TO THIS DRAWING STATE NO AND ISSUE LETTER

# W A R R A N T Y

Our instruments are guaranteed to be free from defects in material and workmanship for one year from the date of purchase (except for tubes, fuses and batteries). Our liability under this warranty is limited to repairs and adjustments or replacements of defective parts or instruments when the fault is a direct result of defective materials or workmanship in the manufacture of the apparatus. This warranty covers service for the first year, except for transportation to and from the factory.

If, during subsequent service, any fault develops in the equipment, the following steps should be taken:

1. Notify us, giving full particulars of the difficulty and include the serial number of the instrument in question. On receipt of this information, we will give you service information or shipping instructions.

2. On receipt of shipping instructions, forward the apparatus to us, prepaid, and we will make repairs and adjustments immediately at the factory.

3. If the fault has been caused by misuse, or abnormal conditions of operation, as disclosed by our examination, repairs will be billed at cost. In this case, an estimate of the cost will be submitted before the work is started.

## CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be tested as soon as it is received. If it fails to operate properly or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent and this report should be forwarded to us. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. When referring to this instrument, always include the model and the serial number.

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